type, and in which the corresponding cells are both homoblastic and equivalent. When the cells, though homoblastic, wholly change their equivalence, or when the cleavage-pattern itself wholly changes, the original homology disappears.

Degeneration in Paramœcium and so-called 'Rejuvenescence' without Conjugation: Gary N. Calkins.

Two individuals, A and B, of *Paramœcium caudatum,* from different sources, were isolated February 1, 1901. These were fed on twenty-four-hour hay-infusion and the number of divisions recorded at periods of from one to three days throughout the year, one individual being isolated each time. At the present time (December 30) A is in the four hundredth and B the three hundred and sixtieth generation, and no conjugation has taken place in the direct line of my cultures. Thus far the experiments have yielded the following results:

1. *Paramœcium* unquestionably passes through more or less regular cycles of activity and weakness.

2. The period of weakness is preceded by one of greater dividing activity.

3. The period of weakness ends in death, provided the diet (hay-infusion) remains the same.

4. Beef-extract restores the weakened functions of growth and division, without conjugation.

5. Normal conjugation between A and B, if followed by the same diet (hay-infusion), does not restore these weakened activities, but is soon followed by death.

6. Exogamous conjugation between wild gametes, and followed by hay-infusion diet, results in normal growth, division and life.

7. Endogamous conjugation does not differ from exogamous conjugation. The ex-conjugants live and divide normally if fed for a time with beef-extract, but die if fed directly with hay-infusion.

8. One intracellular effect of beef-extract upon weakened *Paramœcium* is the formation of 'excretory granules.' Another is the disintegration of the macronucleus.

9. A few conclusions to be drawn are: (*a*) A change of diet is necessary for continued vital activities. (*b*) What we may call parthenogenesis, or the development of gametes without fertilization, may be induced by change of diet. (*c*) Conjugation by itself does not 'rejuvenate.' (*d*) Conjugation probably has some other significance than that usually accepted; what this significance may be is not indicated thus far by my experiments.

Note on Metamerism of the Vertebrate Head: W. A. Locy.

The Median Bundle of the Olfactory Nerve in Elasmobranchs: W. A. Locy.

Fertilization in the Pigeon's Egg: E. H. Harper.

In the pigeon's egg, polyspermy has been found to occur normally. The supernumerary sperm nuclei migrate to the periphery of the germinal disc and give rise to an accessory cleavage. They differ from the cleavage nuclei in the fact that their rate of division is more rapid; in being surrounded by wide areas of liquefaction; in having a finer chromatin network and more slender and elongated chromosomes; and in possessing one-half the somatic number of chromosomes. In their later history as yolk nuclei they divide amitotically. Never more than one sperm nucleus conjugates with the egg nucleus.

In the earliest stage of the fertilized egg observed, the egg was within the mouth of the oviduct. The first polar spindle was present and was surrounded by many sperm nuclei. Spermatozoa penetrate the egg most readily within the region occupied by the germinal vesicle in the ovarian egg, and the pronuclear phenomena also occur about within the limits of this region.

In the first breaking down of the sperm head a number of chromatin vesicles are formed equal to the number of chromosomes in the sperm.

The polar bodies are formed about the time the egg enters the glandular portion of the oviduct. They lie between the vitelline membrane and the cytoplasm.

In cell division, cytoplasmic currents are present. These currents precede nuclear division, and outline the paths by which the daughter nuclei later migrate apart. They are not confined to the immediate neighborhood of the nuclei, but extend into the region of the future blastomeres.

The spindles and asters are very minute in comparison with the size of the blastomeres and the appearance and curved paths of the currents indicate that cytoplasmic division is due to amœboid movements rather than to the tension of astral fibers.

The Development of Color in the Definitive Feather: R. M. STRONG.

The colors of feathers, as was pointed out by Bogdanow ('58), Gadow ('82) and others, are due to the presence of pigment or to special conditions of structure. The pigmentation of the feather takes place in the earlier stages of the development of the feather. The dark brown pigments, commonly classed as melanins, appear to be formed in the cytoplasm of epithelial cells which are differentiated to produce pigment. These pigment cells, or chromatophores, send out branched processes to those cells which are to form pigmented elements of the future feather. Pigment granules pass from these pigment-cell processes into the cells composing the feather fundament. The formation and the distribution of pigment cease before cornification has proceeded far. There is no redistribution of pigment after the feather is fully formed and has burst forth from the sheath enclosing the feather germ.

A New Type of Hyper-metamorphosis: JAMES G. NEEDHAM.

This paper will be published in *Psyche.*

An Experimental Study of Regulation in Stenostoma: C. M. CHILD.

When portions are removed from chains of *Stenostoma* regeneration is complete, provided the piece is not below a certain size. In addition to the regeneration, the piece becomes more slender and narrower, the change first appearing, except under certain conditions, at the posterior end and extending anteriorly until it includes the whole body. The piece does not acquire the same proportions as the original, but approaches them more or less closely.

To explain this change, it is necessary, first, to examine the methods of locomotion and the locomotor structures of *Stenostoma.* The animal, like other rhabdocœls, is covered with cilia which constitute the locomotor organs.

When undisturbed, *Stenostoma* shows a strong tendency to attach itself to the substratum. The attachment by the tail, which is used as a sucker, is especially frequent and the tail adheres more closely than any other part of the ventral surface.

Most of the time when the animal is attached the lateral and dorsal cilia are vibrating and are thus acting in opposition to the organs of attachment; the result is the subjection of the body to a certain amount of mechanical tension. That such tension does exist is evident from a large number of observations.

If we suppose the animal to be attached by the posterior end and the lateral and dorsal cilia vibrating with equal speed and force, the tension upon the tissue at any cross section of the body will be proportional to the number of cilia which are anterior to that cross section, *i. e.,* the ten-